



CABLE-TEC EXPO® 2017

SCTE • ISBE

# THE NEXT BIG...

DEAL  
CONNECTION  
INNOVATION  
TECHNOLOGY  
LEADER  
NETWORK



DENVER, CO  
OCTOBER 17-20





IMPROVING IOT CONNECTIVITY

SCTE · ISBE

# IoT for Peace of Mind

**Arun Ravisankar**

Sr Engineer, Comcast Innovation  
Labs

Comcast



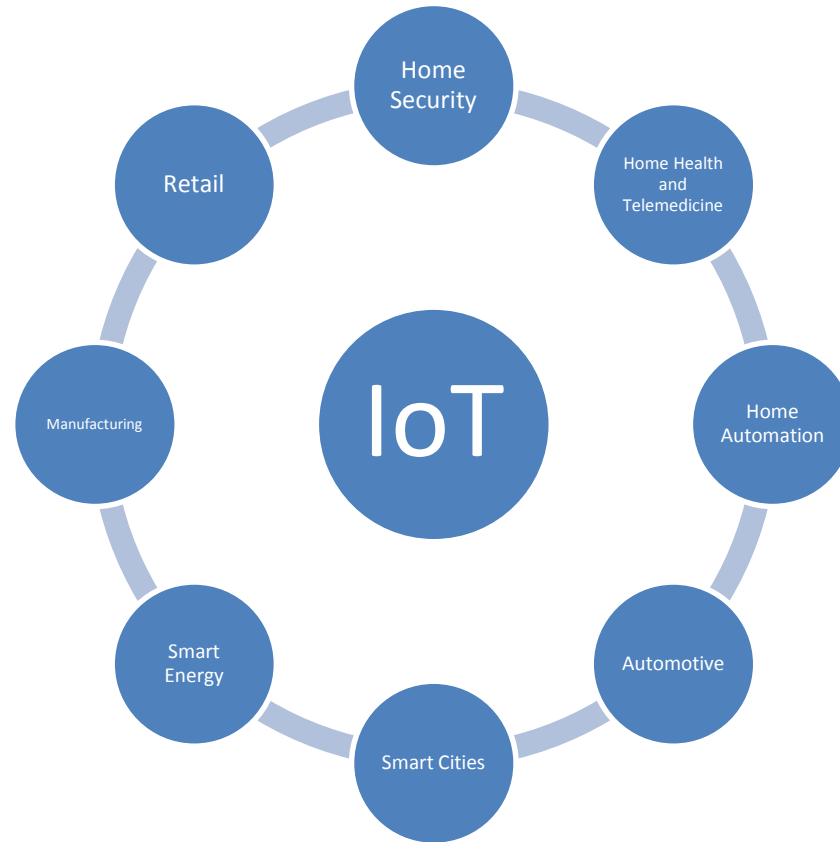
DENVER, CO  
OCTOBER 17-20

# Peace of Mind?

- Sense of relief when you can remotely turn off the stove at home
- Forgot to close the Garage door? Don't worry, you can close it remotely
- Sense of relief when you know your home is being protected when you are away
- Elderly parent living alone? Not to worry, you can get constant updates on:
  - Their well being
  - Alerts if they need help or forgot to take medications
  - Video conference with doctor

# Peace of Mind

The image shows two website screenshots. The top one is for XFINITY HOME, featuring a dark background with a person's face and the text: "A total home security solution. Get peace of mind from the fastest growing home security provider with 24/7 professional monitoring and advanced technology. It's home security made smarter. Because smarter is safer. Based on September 2016 Comparison Of Leading Home Security Providers." Below this is a navigation bar for Care Innovations with links for PRODUCTS, SOLUTIONS, VA CUSTOMERS, RPM ACADEMY, INSIGHTS AND LEADERSHIP, and ABOUT. The main content area highlights "Health Harmony" and "Home Sensing" with a tablet displaying a health session interface and the text: "REDUCE COSTS. IMPROVE OUTCOMES. BRING HEALTH HOME. Care Innovations® Health Harmony simplifies planning and deploying remote care management by providing intuitive and easy-to-use technology and a device agnostic platform for the clinician, patient, and family caregiver." The bottom screenshot is for ALARM.COM, with a navigation bar for SOLUTIONS, PRODUCTS & SERVICES, ABOUT US, PARTNERS, and GET STARTED. It features two promotional banners: "SMARTER HOME SECURITY" with the text "Get best in class security, plus smart home automation the whole family will love." and "SMARTER BUSINESS SECURITY" with the text "Protect your business with security that goes the extra mile to keep you aware and in control — from anywhere."

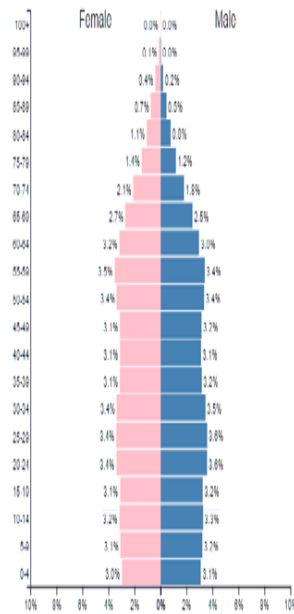


# Health and Wellness

- According to [Forbes](#), “It costs families more to care for a frail older adult than to raise a child for the first 17 years of her life.” This is a growing concern.
- An [AARP publication](#) reported in late 2015 that the population of adults 85 and older in the U.S. would roughly triple between 2015 and 2060 – making it the fastest-growing age group over this time.
- Apart from elder care, IOT will help individual to track personal health and wellbeing with the use of various fitness based devices.

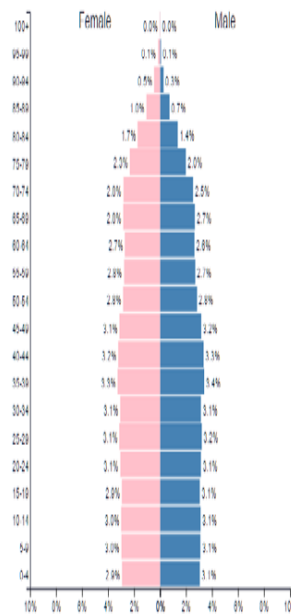
United States of America ▼  
 2017

Population 326,474,013



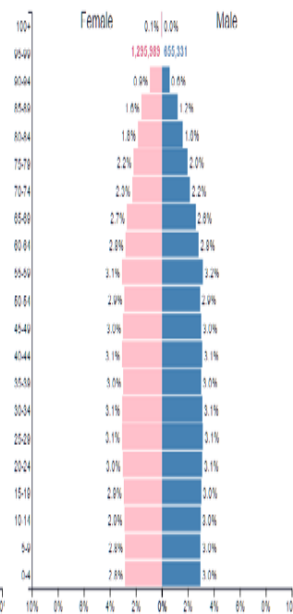
United States of America ▼  
 2032

Population 359,704,074



United States of America ▼  
 2050

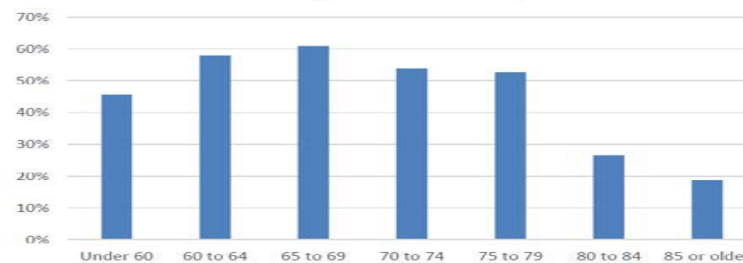
Population 388,864,747



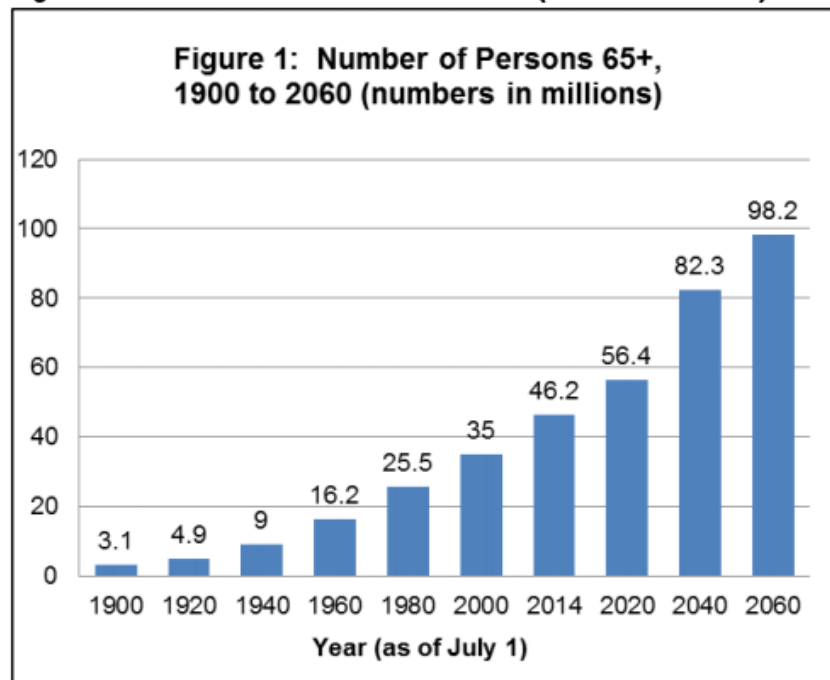
### Age 75+ non-Internet use since 2000

Year	Percent	Base Count
2015	50%	757
2014	57%	624
2013	60%	1392
2012	62%	2315
2011	65%	804
2010	71%	1873
2009	71%	1033
2008	74%	1762
2007	77%	1304
2006	78%	1739
2005	82%	1450
2004	88%	1127
2003	88%	1157
2002	89%	1482
2001	93%	1370
2000	93%	2771

### Smartphone ownership



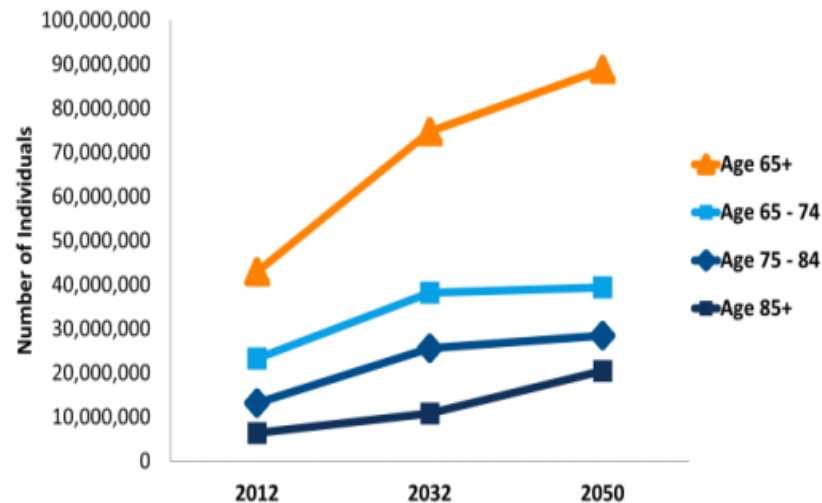
**Figure 1: Number of Persons 65+: 1900-2060 (numbers in millions)**



Note: Increments in years are uneven.

Source: U.S. Census Bureau, Population Estimates and Projections.

**The 65 and Over Population Will More Than Double and the 85 and Over Population Will More Than Triple by 2050**



SOURCE: A. Houser, W. Fox-Grage, and K. Ujvari. *Across the States 2013: Profiles of Long-Term Services and Supports* (Washington, DC: AARP Public Policy Institute, September 2012), [http://www.aarp.org/content/dam/aarp/research/public\\_policy\\_institute/ltc/2012/across-the-states-2012-full-report-AARP-ppi-ltc.pdf](http://www.aarp.org/content/dam/aarp/research/public_policy_institute/ltc/2012/across-the-states-2012-full-report-AARP-ppi-ltc.pdf).



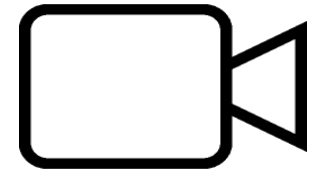
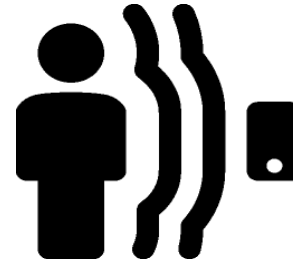
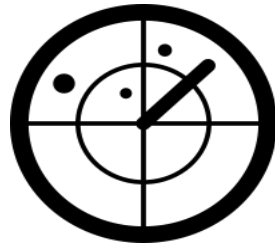


# Why IoT for Healthcare?

- Applications like ADL Monitoring and Remote Patient Monitoring would help reduce the number of visits to a care provider. This would also help reduce the burden on conventional healthcare systems (hospitals and clinics)
- Medicare has begun implementing incentives to reduce hospital readmissions, which is stimulating growth in remote patient monitoring. The [Hospital Readmission Reduction Program](#) (HRRP) financially penalizes hospitals with relatively high rates of Medicare readmissions
- Remote patient monitoring could be used to derive health and wellness information, which can provide first-hand information to patients and caregivers/family members
- Apart from eldercare, these technologies could be tailored to assist patients with chronic conditions

# Connected Health Applications

# Monitoring the Activities of Daily Living



## Biometric Monitoring



## Patient Adherence

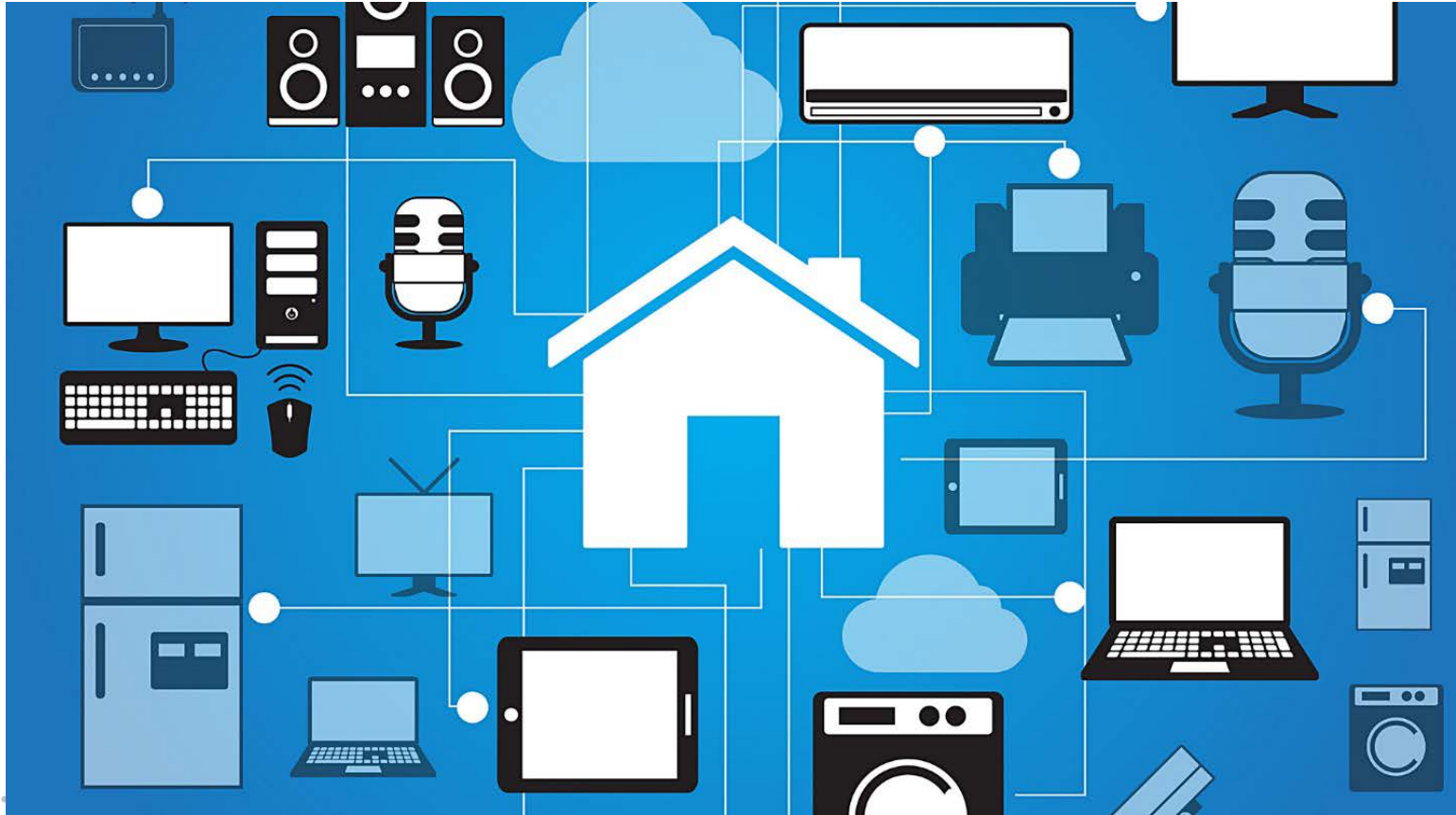
Technology can ensure patients adhere to doctor prescription

- Provide appropriate reminders to patients and family members
- Refill reminders

## Virtual Visits

Meet doctor or care provider over video conference

# Home Monitoring and Security



- Motion-detecting cameras and monitoring equipment, with local or cloud-based event recording
- Sensors for changes in status of windows and doors
- Catastrophe detection (fire/flood sensors)
- Indications of events that are of concern (out of normal)
- Class of sensors - that provide indications of abnormal events.
- Alerts/Events to user

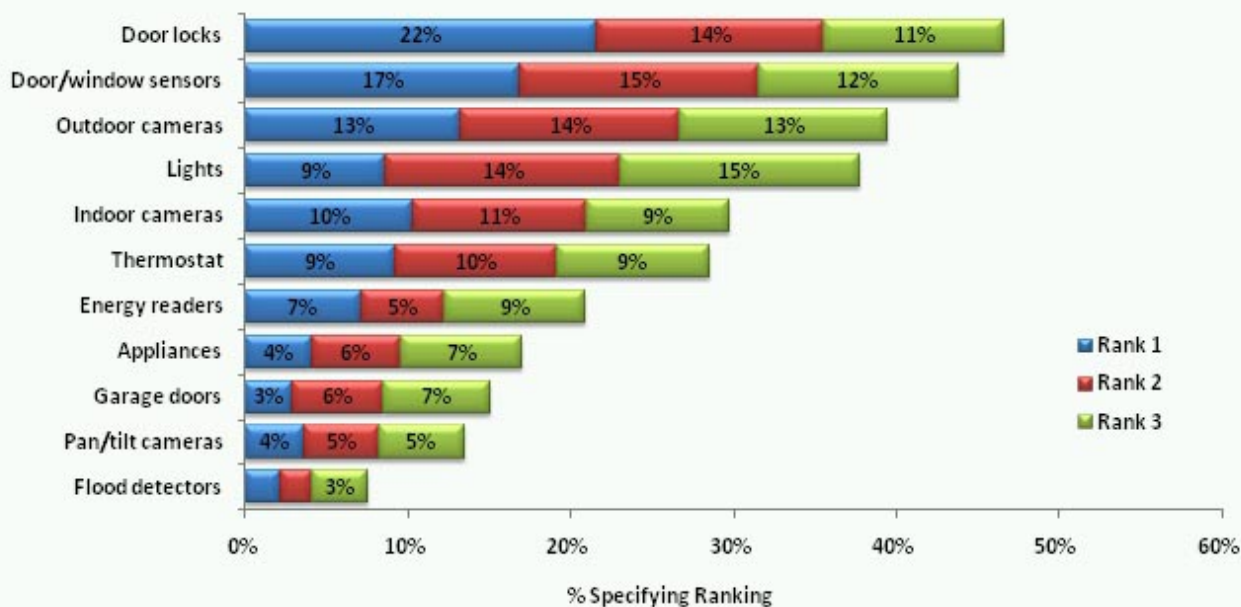


## Most Desired Capabilities for Home Monitoring and Management System (Q2/12)

"Q7005. Which of the following capabilities would you most desire in a home monitoring and management system?"

The ability to automate, control and monitor..."

(Among All BB HHs, n=2,517, ±1.95%)





**XFINITY HOME FEATURES**

## Connected and protected

Protect your family and home and look after them from anywhere with an Internet connection using your smartphone, tablet or computer, with XFINITY Home.

**SMART HOME CONTROL**

### Stay connected to your home from anywhere

In addition to remotely arming and disarming your system with the XFINITY Home app, you can also look after and control your home from anywhere. With additional equipment, get live video monitoring so you can see that your kids got home safely, control your thermostat and turn on lights so you never come home to a dark house again, and much more.



**VIDEO MONITORING**

### Be in the know, even when you're away

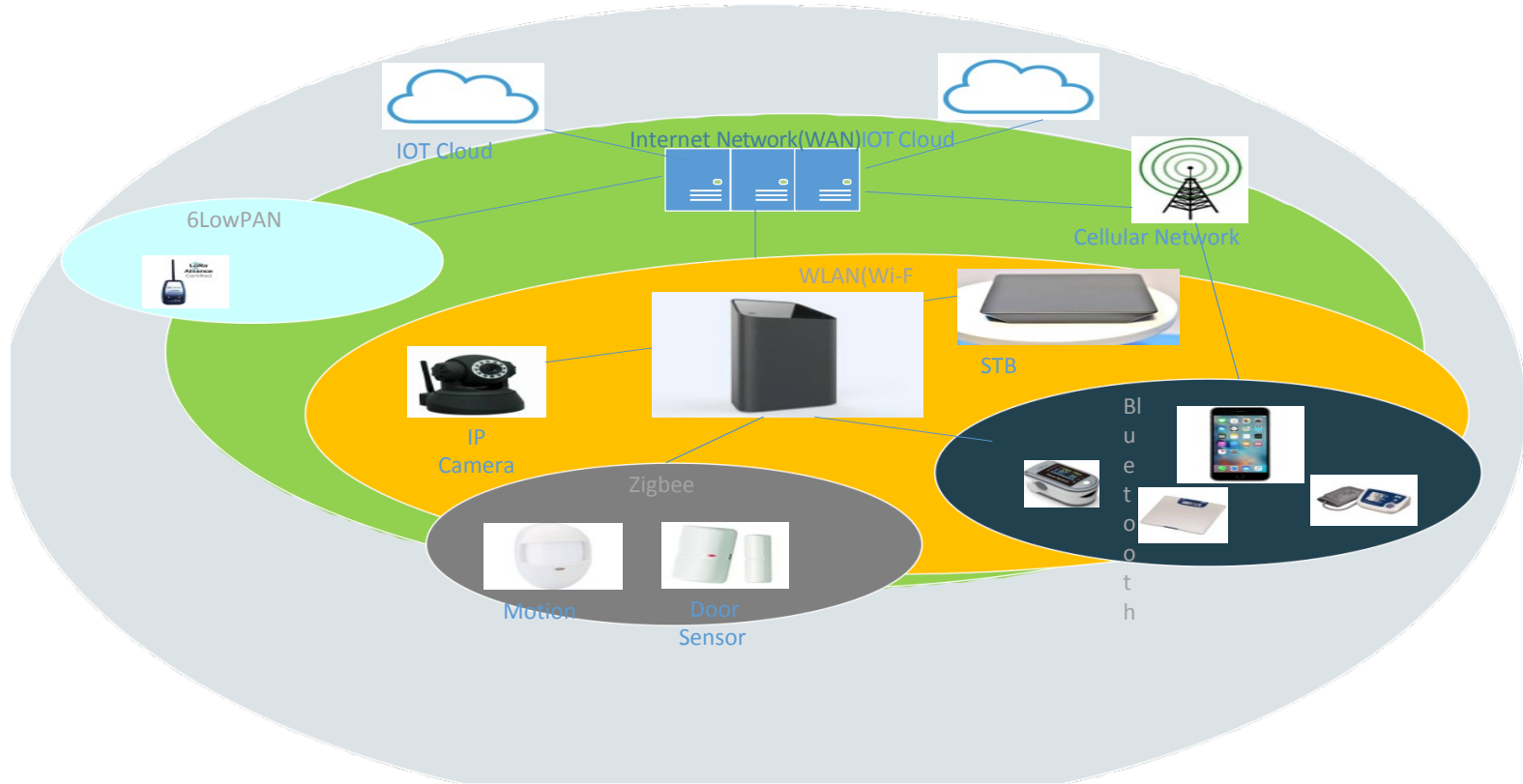
See what's happening in and around your home in real time with live video monitoring, included in your monthly XFINITY Home service; you'll just need to add a camera to your system. For an additional \$9.95/mo. per camera\*, rewind, review and share up to 10 days of footage in the cloud with 24/7 Video Recording.

\*Taxes and fees extra. Pricing subject to change.

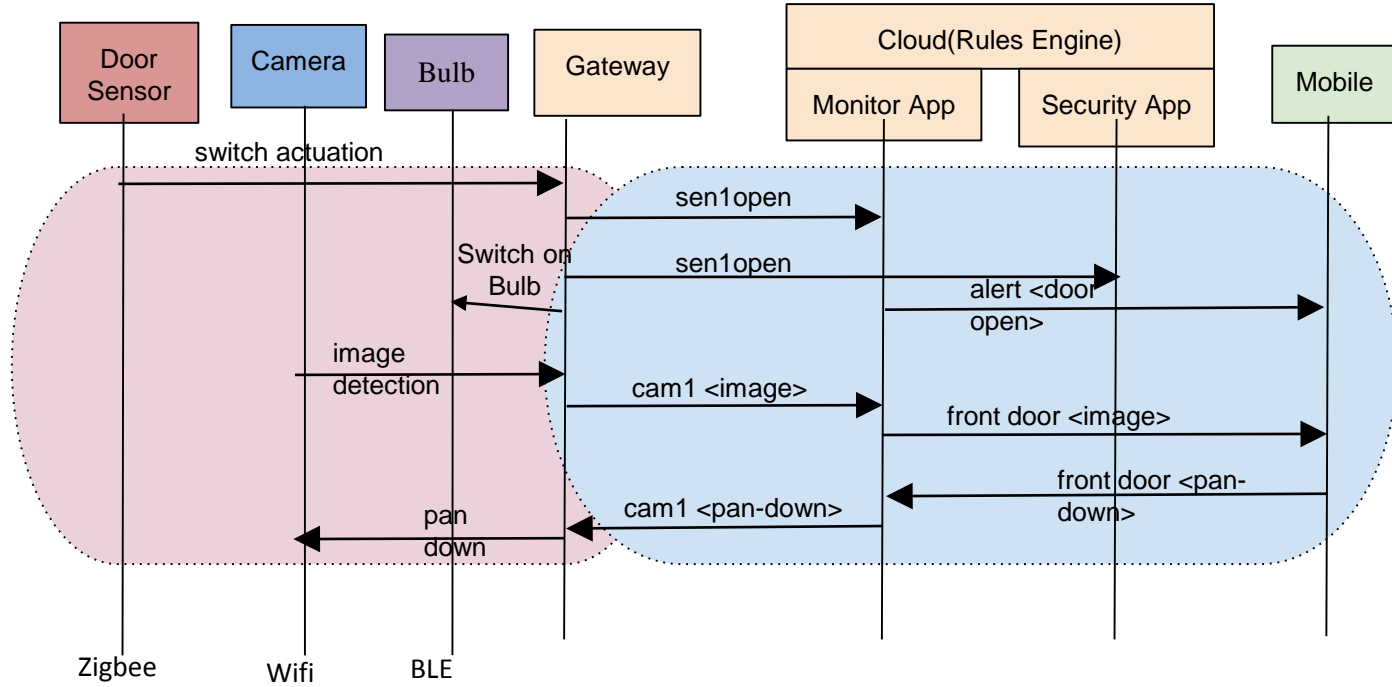
[Learn About Video Monitoring](#)



# Technology Overview

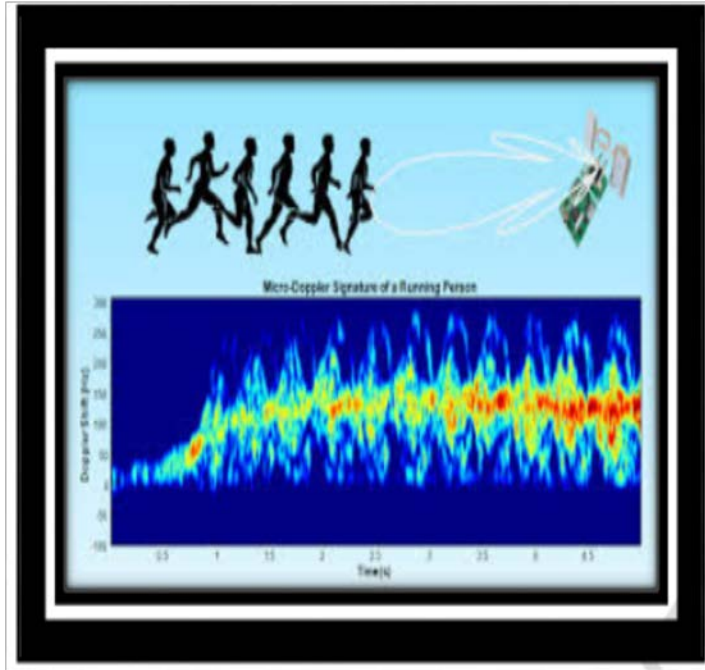


# Sample Sequence Diagram

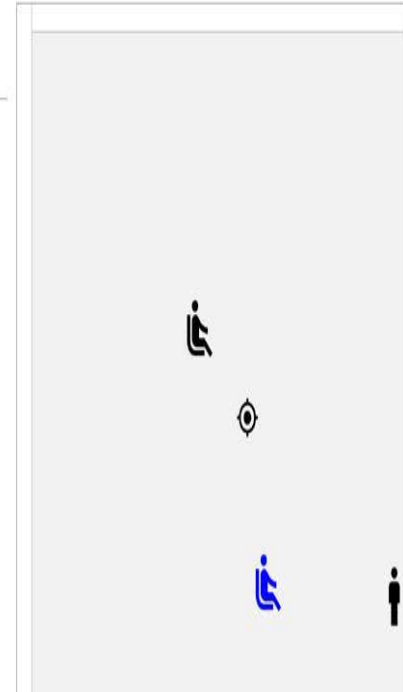
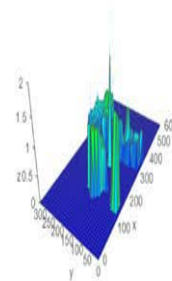


# Technologies of great promise

# RF Sensing for IOT Applications



## 3D-View



## Information

Total  
 Personne **3** Meeting Room **0** Office **3**

### Person 1

Location: Office (0.18, 1.30)

Posture: **Sitting**

Movement Level: **Light Movement**

### Person 2

Location: Office (-1.27, 1.40)

Posture: **Standing**

Movement Level: **Not Moving**

### Person 3

Location: Office (0.41, -0.69)

Posture: **Sitting**

Movement Level: **Not Moving**



# Sensors to Insights

- Integrate various devices and sensors
- Collect data
- Analyze collected data
- Visualize
- Use Analytics and Machine Learning



Integrate



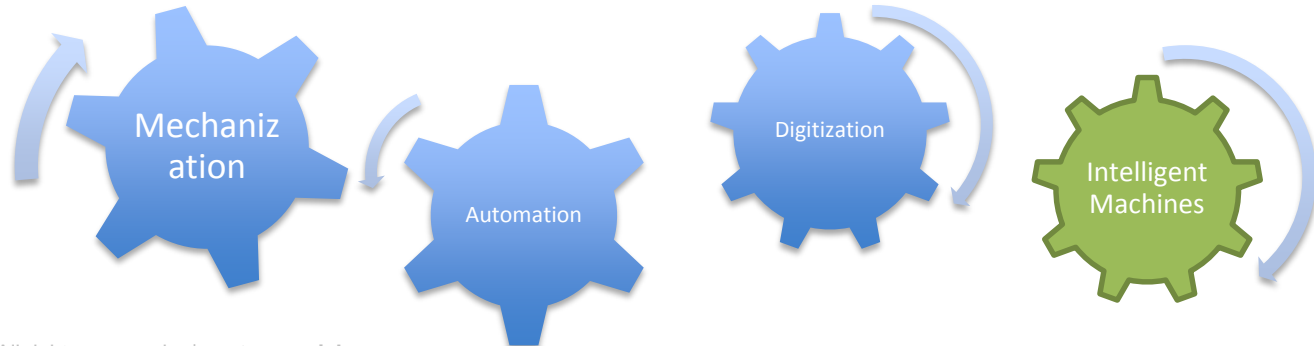
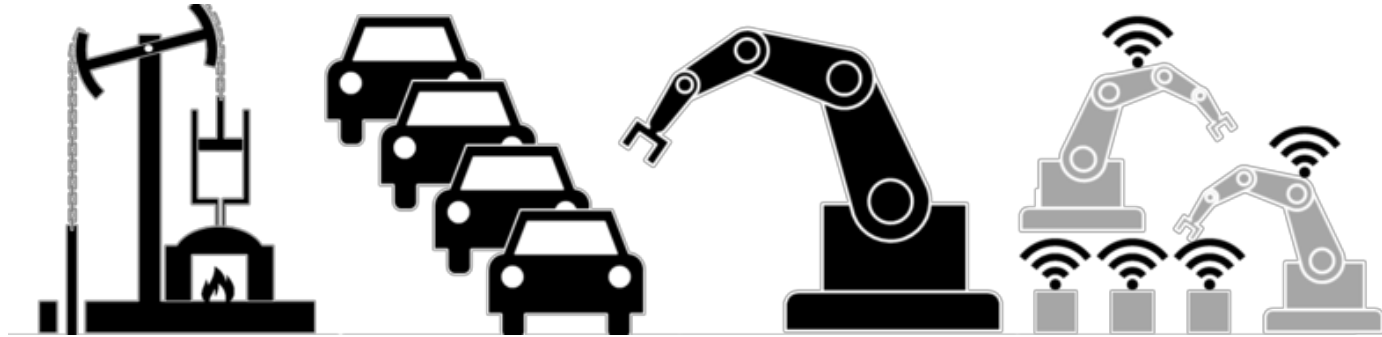
Analyze



Visualize

# Sensors to Insights

The Fourth Industrial Revolution will apply to Smart Home and Home Healthcare



# Long Range IoT Networks

**The most powerful complete long range IoT connectivity solution for Low Power Wide Area Networks (LPWAN)**

LoRa™ End Nodes      Gateways      Cloud Based Network Controller

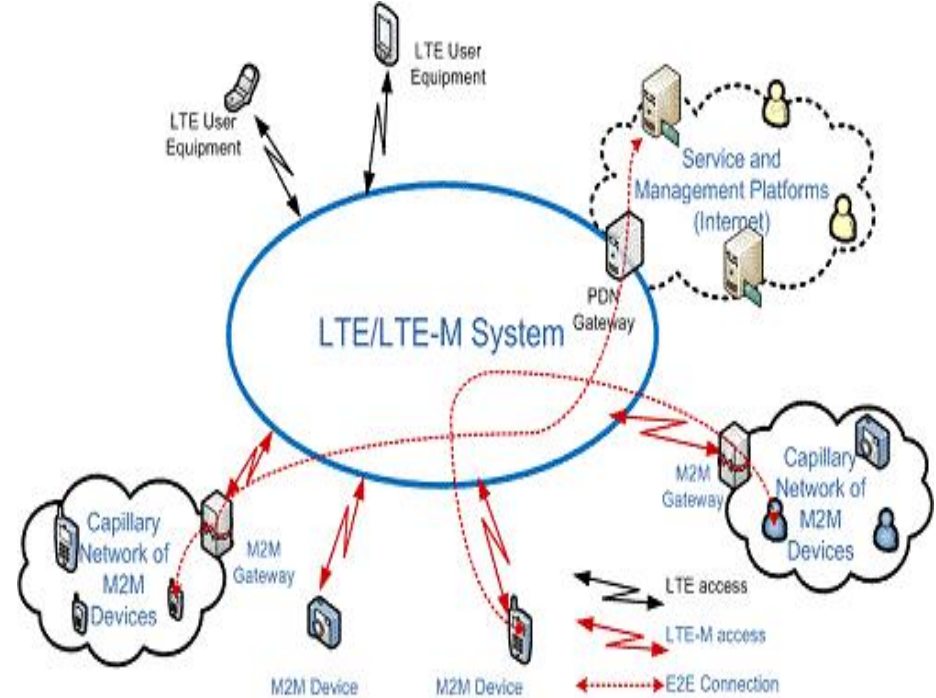
**LoRa™ Network Benefits**

- Long range → 15-20km
- Millions of nodes
- Long battery life → over 10 years






www.lora-alliance.org      #loraalliance

**THREE EASY STEPS FOR A COMPLETE SOLUTION DEPLOYMENT**

STEP ONE	STEP TWO	STEP THREE
Select End-Node Module	Select Gateway Solution	Provision Gateway to Network Controller



# Long Range IoT Networks

	<b>SIGFOX</b> 	<b>LoRa</b> 	<b>clean slate</b>  <b>cloT</b>	<b>NB LTE-M</b> Rel. 13 	<b>LTE-M</b> Rel. 12/13 	<b>EC-GSM</b> Rel. 13 	<b>5G</b> (targets) <b>5G</b>
Range (outdoor) MCL	<13km 160 dB	<11km 157 dB	<15km 164 dB	<15km 164 dB	<11km 156 dB	<15km 164 dB	<15km 164 dB
Spectrum Bandwidth	Unlicensed 900MHz 100Hz	Unlicensed 900MHz <500kHz	Licensed 7-900MHz 200kHz or dedicated	Licensed 7-900MHz 200kHz or shared	Licensed 7-900MHz 1.4 MHz or shared	Licensed 8-900MHz 2.4 MHz or shared	Licensed 7-900MHz shared
Data rate	<100bps	<10 kbps	<50kbps	<150kbps	<1 Mbps	10kbps	<1 Mbps
Battery life	>10 years	>10 years	>10 years	>10 years	>10 years	>10 years	>10 years

# Conclusion

- We looked at various potential use case and discussed a brief technical overview.
  - These technology aim to provide “*Peace of Mind*” to the consumer.
- Looked at technologies of promise and their applicability in IoT
- Emphasized the importance of Machine Learning
- Emerging Long Range IoT Networks
- For more information, please see the technical paper at the SCTE website.

SCTE · ISBE

**THANK YOU!**

Arun Ravisankar

[Arun\\_Ravisankar@Cable.Comcast.com](mailto:Arun_Ravisankar@Cable.Comcast.com)

215-286-7558



DENVER, CO  
OCTOBER 17-20

